

GIS DATA AND APPLICATION DEVELOPMENT PARTNERSHIPS

San Diego Association of Governments

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Over the past decade, the San Diego Association of Governments (SANDAG) has been involved in forming a number of partnerships in the San Diego region. These partnerships were formed for both the development and acquisition of region-wide geographic information system (GIS) vector and digital imagery databases, and for the development of applications beneficial to multiple agencies.

Data development and data acquisition partnerships provide a number of general benefits. One obvious benefit is spreading the cost to create a database or an application, thereby significantly reducing the cost to any one agency. Without partnerships and pooling of funds, certain databases and applications may not be developed at all. Partnering can also reduce data redundancy between agencies and allow higher resolution data and a broader area of coverage to be obtained, thus making the data useful for a wider variety of applications and users. Partnerships also get more agencies involved, increasing the benefits at no additional costs. Benefits to joint application development include the standardization of data input and outputs across agencies, access to data outside of any one agency, and broader use and acceptance of information.

The following pages describe in more detail the data acquisition and application development partnerships that have been formed by SANDAG in the San Diego region. Many of the databases and applications developed by these partnerships are accessible from SANDAG's Web site (www.sandag.org).

DATA DEVELOPMENT AND ACQUISITION PARTNERSHIPS

Elevation Contours

The 20-foot and 40-foot elevation contours from the 1:24,000 scale USGS 7 1/2 minute quad sheets have been converted to a digital database. The California Department of Parks and Recreation created the digital files for quads containing state park lands and San Diego State University (SDSU) created digital contours for the quads of the Tijuana River Watershed. Generation of contours for the remaining quads in the San Diego region were funded by a five-agency partnership; comprised of SANDAG, the County Public Works Department and Department of Planning and Land Use, Caltrans, and the Southern California Metropolitan Water District.

The local partnership also funded the creation of a regional contour database (by merging the individual quad data), and the creation of both

a 30-meter and a 10-meter Digital Elevation Model (DEM) from the contour data.

Working in cooperation with the USGS, the Center for Earth Systems Analysis Research (CESAR) lab at SDSU's Department of Geography conducted all the work for this project. The cost for creating the individual quad databases and the regional contour database was estimated to be about \$125,000. In order to get region-wide coverage, each of the five agencies in the partnership contributed \$8,000.

Soils Series

SDSU's Department of Geography's CESAR lab created digital files for all of the 1:24,000 scale Soil Conservation Service maps in the region. To help complete the project and create a regional file, SANDAG helped fund this effort and assisted in the quality control.

National Hydrography Dataset (NHD)

The NHD is a hydrographic data set that was developed for the entire United States at a 1:100,000 scale. The data set is based on the blue line stream information on the standard USGS topographic maps, which has been enhanced with attribute data to allow for modeling stream flows through watersheds. The NHD data set is extremely useful for water quality and stormwater runoff studies.

Under a new effort, the USGS approached SANDAG about working with them and the U.S. Forest Service to create a high-resolution, 1:24,000 scale, data set for the entire region. SANDAG contributed \$10,000 toward the effort, and assisted with the quality control in order to make the data available in a timely manner to support the local Stormwater Permit compliance requirements. The 1:24,000 scale NHD data for San Diego was one of the first data sets to be completed in the nation.

Satellite Imagery

A five-agency partnership (SANDAG, SDSU, the County of San Diego, Caltrans, and State Parks and Recreation) funded the acquisition of 1995 SPOT satellite imagery. Both panchromatic (10-meter) and multi-spectral (20-meter) imagery were obtained for the San Diego region and the Tijuana River Valley watershed. The imagery is from the summer of 1995 and was used in multi-date change detection projects to update land use and vegetation vector databases. A single agency license for this imagery was \$48,000. The cost for a five-agency license was only \$67,000, thereby reducing the cost per agency to only \$13,500.

Black and White Digital Orthophoto Quarter Quads (DOQQ)

SANDAG, on behalf of 15 other local agencies, partnered with USGS to create one-meter resolution black and white digital orthophoto quarter quads. The DOQQs were based on aerial photos taken in the summer of 1994 and 1995. This project, combined with a

USGS/Cleveland National Forest project, provided DOQQ imagery for the entire San Diego region. The County of San Diego provided geodetic control for the project and the USGS 30-meter DEM was used for elevational control in the orthorectification process. The total cost for the DOQQs, including the flights, aerial photography, and the creation of DOQQs was estimated at over \$400,000. The local partnership contributed a total of \$80,000 towards the project.

Standard USGS DOQQ products are created and delivered in the Universal Transverse Mercator Projection (UTM) coordinate system, with meters as the unit of measure, and are not tonally balanced across DOQQ tiles. Since most of the local agencies in the San Diego region use the California State Plane coordinate system with feet as the unit of measure, the USGS products weren't readily integrated into local agencies' geographic information systems. In addition, there can be extreme tonal variation between the imagery of adjoining quads, thereby causing visible seamlines and checkerboard affects during viewing and plotting.

On behalf of the original local partnership, SANDAG took the lead on a Request for Proposal (RFP) and contract to prepare value-added products from the standard USGS DOQQs. The value-added image processing included re-projecting the DOQQs from UTM to State Plane Coordinates, re-sampling the one-meter pixels to three-foot pixels, tonal balancing across image tiles, and creating compressed Multi-resolution Seamless Image Databases (MrSID) products.

Thirteen additional agencies partnered to pay for the value-added image processing and the creation of MrSID products. Since the MrSID technology was new at the time, special applications were developed to interface the MrSID images with ArcView 3.0 and workstation ARC/INFO 7.1. Agency contributions were less than \$2,000 for the final value-added image products.

False Color Infra-Red (CIR) Digital Orthophoto Quarter Quads

As part of the U.S./Mexico Aerial Photography Program, color infra-red (CIR) photography was flown in 1996 along the International Border from California to Texas. The northwest portion of San Diego region was not included in the original flight. SANDAG paid to acquire this photography in 1997, and the USGS prepared their standard one-meter DOQQ products from both these acquisition efforts. Since standard USGS DOQQs were not readily usable by the local agencies in the San Diego region (for the same reasons stated above in the black and white DOQQ partnership), SANDAG formed a partnership to fund the creation of value-added products (re-projection, re-sampling pixel resolution, radiometric balancing, and creation of MrSID imagery) from the USGS quarter quads.

Each agency in the CIR partnership contributed an equal share of the cost of the value-added image processing. Each agency had the option of obtaining MrSID images for the entire San Diego region or a MrSID image for their user-defined area of interest. Partners requiring regional coverage contributed an equal share of the cost to create the regional MrSID imagery, while agencies only requiring a subarea contributed a variable amount associated with the costs to create their subarea MrSID. The total cost to prepare the value-added products for this partnership was \$55,500. Smaller agencies requiring user-defined subareas contributed \$2,000 or less, while agencies requiring regional coverage contributed only around \$4,300.

Year 2000 Digital Imagery

Based on local agency desires to have higher resolution and more up-to-date digital imagery, in the spring of 2000, SANDAG took the lead in issuing an RFP to determine what types of digital imagery, what resolution, and

what area of coverage could be obtained for what cost. Based on proposals received, SANDAG formed a partnership to fund the creation of year 2000, CIR, 2-foot resolution digital ortho imagery for the entire region. Based on overwhelming response to this type of digital image product, 30 public and private agencies partnered to fund the development of the imagery.

The imagery was captured between June and September 2000, and was orthorectified using the 1996/1997 USGS Digital Ortho Quarter Quads as ground control and a 10-meter DEM for elevation control (generated from the 20-foot and 40-foot contours previously described). As such, the imagery has a positional accuracy similar to the USGS DOQQs.

Final image products were provided in MrSID format. To make distribution of final MrSID products easier, standardized MrSID areas were defined for this project. Three subareas MrSID products (NW, SW, NE) were created for partners requiring a smaller area of coverage. Two regional MrSID products (west and east) were created for the regional partners.

The total cost of the project was just over \$113,000. Individual agency contributions varied depending upon the area of coverage required. Agencies requiring digital imagery for the entire region contributed \$10,000, whereas agencies only requiring coverage for a smaller portion of the region (city, water district), contributed \$2,000.

2001 Digital Imagery – San Diego County Water Authority and Other Agencies

In 2001, the San Diego County Water Authority issued an RFP to acquire true color imagery and topographic data along the corridor of its major aqueduct system. Before issuing the RFP, the water authority solicited other agencies in the region, including water districts and municipalities, to participate in the RFP as an optional area of interest. Five local municipalities

included their jurisdiction within the RFP without obligating funding to the project. Most importantly, the RFP included a public agency clause allowing any public agency in the San Diego region to participate in the award made as a result of the solicitation. Therefore, only one agency was responsible for conducting the solicitation process, and all agencies could then contract with the selected firm to acquire digital imagery for their area of interest. Six agencies negotiated six separate contracts with one aerial mapping firm. These included the San Diego County Water Authority, City of Carlsbad, City of Chula Vista, City of Coronado, City of Encinitas, and the City of Oceanside. The combined area of coverage was 215 square miles.

While this was not a formal partnership, the agencies involved did form a loose relationship and did realize cost savings. The core products of the project for all agencies involved were true color imagery with 6-inch pixel resolution and 2-foot contour data. Final digital image products were delivered to each agency in the compressed MrSID format.

2004 Digital Imagery – South Bay Region

The 2004 partnership was very similar in nature to the 2001 partnership described above. In 2004, the City of Chula Vista needed updated imagery and terrain data for their jurisdiction and outreached to other nearby agencies to determine if others had similar needs. The City issued the RFP with eight additional agencies opting to join in on the City's project. While this was not a formal partnership, the agencies involved did form a loose relationship and did realize cost savings. Only one agency was responsible for conducting the solicitation process, and all other partnering agencies negotiated their own contracts and products for their areas of interest with the vendor selected by the City.

The other agencies that joined the City of Chula Vista's effort included: the Cities of Coronado, Imperial Beach, National City,

Escondido, Otay Water District, the Sweetwater Authority, the Port District, and the Navy.

The project covered 275 square miles and the core products for all agencies involved were true color imagery with a 6-inch pixel resolution and 2-foot contour data. In addition, an updated 2-foot resolution digital terrain model (DTM) was created for this project. The terrain model was created from the imagery using traditional photogrammetric methods. The total cost for the project was \$313,500.

2005 Digital Imagery – City of San Diego and Other Agencies

The 2005 subregional partnership was very similar in nature to the 2001 and 2004 partnerships described above. In 2005, the City of San Diego needed updated imagery and terrain data. Based on the public agency clause in the City's contract and with consent from the City, SANDAG facilitated the outreach to other agencies in the region to determine who else might be interested in participating in the City's project. Although not a formal partnership, the 15 agencies involved in the project did realize a significant cost savings. The City was responsible for conducting the solicitation process. All other partnering agencies negotiated their own contracts and products for their areas of interest with the vendor selected by the City.

The other agencies that joined the City of San Diego's effort included: the Cities of Carlsbad, Chula Vista, Del Mar, Encinitas, La Mesa, Lemon Grove, Oceanside, Poway, Santee, Vista, Valley Center Municipal Water District, Borrego Water District, San Diego State University, and the San Diego Wild Animal Park. The combined project area covered 820 square miles. With a few exceptions, the core products for the project were true color imagery with 3-inch pixel resolution, a LIDAR generated terrain model with 5-foot horizontal postings and 2-foot contour data. The total cost for this project was \$1,012,500.

APPLICATION DEVELOPMENT PARTNERSHIPS

View2Transit

View2Transit is a customized ArcView tool for transit planning and marketing in the San Diego region. Since SANDAG regularly provides the transit operators with data, technical assistance, and standard hardcopy reports on transit ridership, View2Transit is a tool for the transit operators to answer some of their own questions directly. It enables the non-GIS professional to easily query demographic and transit ridership data and to produce their own customized reports on current and forecast transit ridership, population, housing, and employment for user-defined areas around transit facilities, bus stops, or transit routes. The initial project start-up costs were \$50,000, with no direct-cost to the transit agencies. SANDAG created the application with cooperation, assistance, and in-kind services from the local transit operators (San Diego Transit, Metropolitan Transit Development Board, San Diego Trolley, Chula Vista Transit, San Diego County Transit System, and the North San Diego County Transit District).

The benefits to this application are: consolidation of information used to answer planning and marketing questions, standardization of reporting and analysis, easier and faster ways to get answers, and being able to answer questions in-house. Originally developed and released in 1995, the View2Transit application and databases have been updated annually. The application is being used by transportation agencies throughout the region.

Industrial Clusters

Industrial clusters are groups of complementary, competing, and inter-dependent industries that drive economics primarily through the export of goods and services. They are a way of looking at

employment information more effectively by focusing on the economic drivers of our modern economy. Many of today's new and emerging industries (such as biotechnology, software development, environmental technologies, and communications) do not fit well within the broad, traditional industry categories of the standard industrial classification (SIC) system. Detailed SIC codes are still used to classify individual businesses, but the industrial clusters application represents aggregate data in more meaningful and useful groups that better reflect the major employment sectors of the modern economy. In order to provide the quality and assurance necessary for clusters to be used by local decision-makers, a standardized and replicative process was created to identify and define regional industrial clusters. The process revolves around a set of technical criteria that focus on various aspects of the clusters, such as export-orientation and inter-relationships. The industrial clusters are part of the foundation of SANDAG's Regional Economic Prosperity Strategy for the San Diego region.

To enhance its use, the industrial clusters data also was combined with a GIS address-based application and placed on the Internet (Environmental Systems Research Institute's [ESRI's] Map Objects/Internet Map Server). The web-based application allows users to see which businesses are part of the region's driving clusters, and where they are located within San Diego. The application also includes reports about the region's clusters and allows the user to interactively create queries on employment data.

The total cost to develop this application was \$50,000. The San Diego Regional Technology Alliance (RTA) funded the development of this application, while SANDAG and SourcePoint (SANDAG's non-profit corporation) provided data, programming, and direction to the

project. Although initially funded solely by the RTA, the industrial cluster information is now being used region-wide by various groups such as the San Diego Workforce Partnership, San Diego Regional Economic Development Corporation, and various city and county agencies.

Regional Economic Development Information System (REDI)

SANDAG developed REDI in cooperation with the San Diego Geographic Information Source (SanGIS). REDI is a web-based Internet application intended to assist industrial land developers, economic development analysts, small business owners, community planners, and others to explore land development opportunities. REDI helps a user visualize the relationships between existing land use, planned land use, vacant land, traffic volumes, and much more to assist in determining the development potential of land in the region. Users can query the REDI system to find areas with desired/suitable characteristics for industrial development. In addition, to assist with market research efforts for potential industrial site locations, users can retrieve demographic and economic profiles for user-defined areas of interest.

The SANDAG/SanGIS partnership added value to the application by allowing SANDAG to use SanGIS's proprietary parcel database and information in the REDI application, and also provided SanGIS with a desired application they didn't have to develop independently.

HabiTrak

Local agencies in the San Diego region (jurisdictions, water districts, and other special districts such as Sempra Energy and the San Diego County Water Authority) are completing subarea habitat conservation plans under the State of California's Natural Communities Conservation Plan (NCCP) program. The habitat conservation plans are designed to define and delineate large blocks of

inter-connected habitats that are to be conserved as permanent open space to provide long-term protection of a suite of plant and animal species. In exchange for the long-term protection of species, the local agencies gain the authority to issue development permits for the take of threatened and endangered species without the involvement of the state and federal wildlife agencies (California Department of Fish and Game and the U. S. Fish and Wildlife Service).

HabiTrak uses standardized data and a standard methodology to spatially track and report on habitats lost and conserved over time. The application prepares a set of tables and maps summarizing the information for each year. The reports are provided to the wildlife agencies on an annual basis to determine if habitat preservation is occurring in rough-step with development and that the agreed upon conservation goals are being achieved. Since the data and reports are standardized, the information can be aggregated across subareas to obtain subregional profiles of habitats lost and conserved over time.

The wildlife agencies funded the development of HabiTrak. Local agencies and the wildlife agencies formed a subcommittee to define the inputs, outputs, and desired functionality of the application. HabiTrak is designed using ESRI's ArcView 3.X software and is a stand-alone, distributed, low-cost, user-friendly application that can be used by non-GIS professionals.

The total cost to develop the habitat tracking tool was just under \$100,000, with annual funding to maintain and expand the capabilities of the application. While the development and maintenance of HabiTrak was funded by the wildlife agencies, local agencies contributed to the project by providing in-kind services in defining the functionality of the tool and contents of the reports and maps generated from HabiTrak. SANDAG provided multi-agency coordination and management on the project.

